ACTIVE THERMAL CONTROL OF THE MICROMETEOROID CAPSULE ELECTRONICS

Introduction

Thermal louvers, similar to those on Mariner II, are to be used on the MMC electronics canister for thermal control. At the present time, it is felt that all louver applications, laboratory test results, and flight data are a necessary and complimentary part of louver development.

Figure 1 shows the spacecraft. Figure 2 shows the micrometeoroid panels being constructed. Notice the size of the man in the figure relative to the size of the spacecraft.

Thermal Design

The design philosophy is to locate all the temperature sensitive electronics components in an electronics canister and control the canister temperature with thermal louvers. The canister is shown in Figure 3, a thermal schematic of the spacecraft. The louvers are positioned so as to eliminate incident solar radiation. The heat transfer through the louvers is strictly infrared radiant transfer to the vehicle (as a sink). The vehicle coating will be a stable white paint.

The interior of the canister is shown in Figure 4. Special mounting techniques are employed for the extra-sensitive batteries to maximize the contact area.

Figure 5 shows the canister mock-up being used for the thermal vacuum tests now in progress. Two bays of louvers are attached to the lower face of the canister. The other faces consist of superinsulation sandwiched between two stiff panels.

An idea of the number of times the louvers are expected to actuate in orbit can be obtained from Figure 6, which shows typical curves for time in sunlight for the spacecraft. A minimum of four major actuations are expected, and probably more, depending upon attitude variations. One of the louver bays is shown in Figure 7. Each louver bay weighs approximately two pounds, has a total blade area of 1.7 ft^2, is actuated by bimetallic spirals (with each blade being independently actuated) whose temperature is radiatively linked to the components, and has a highly polished aluminum blade surface. The actuators are thermally isolated from the structure and sink by a special superinsulated housing with an open face towards the components. The free end of the blade rides in a teflon bushing to prevent cold welding and reduce friction. Fabrication problems have been encountered in adhering to the rigid tolerances imposed. Hand selection of parts has become necessary.

Thermal vacuum tests are presently being conducted to check the thermal design, especially in the operation of the louvers. Preliminary results show the design to be verified.

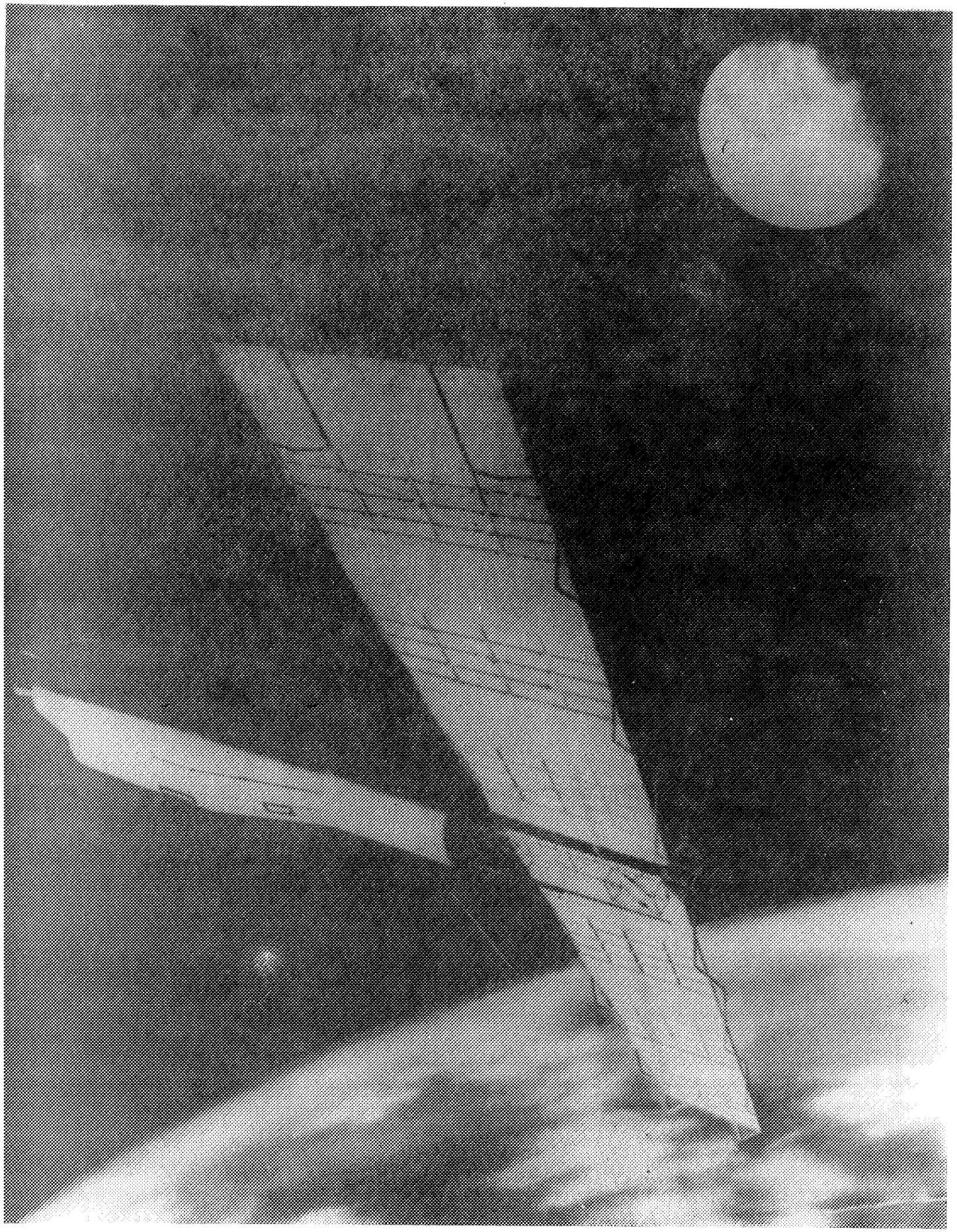

FIGURE 1

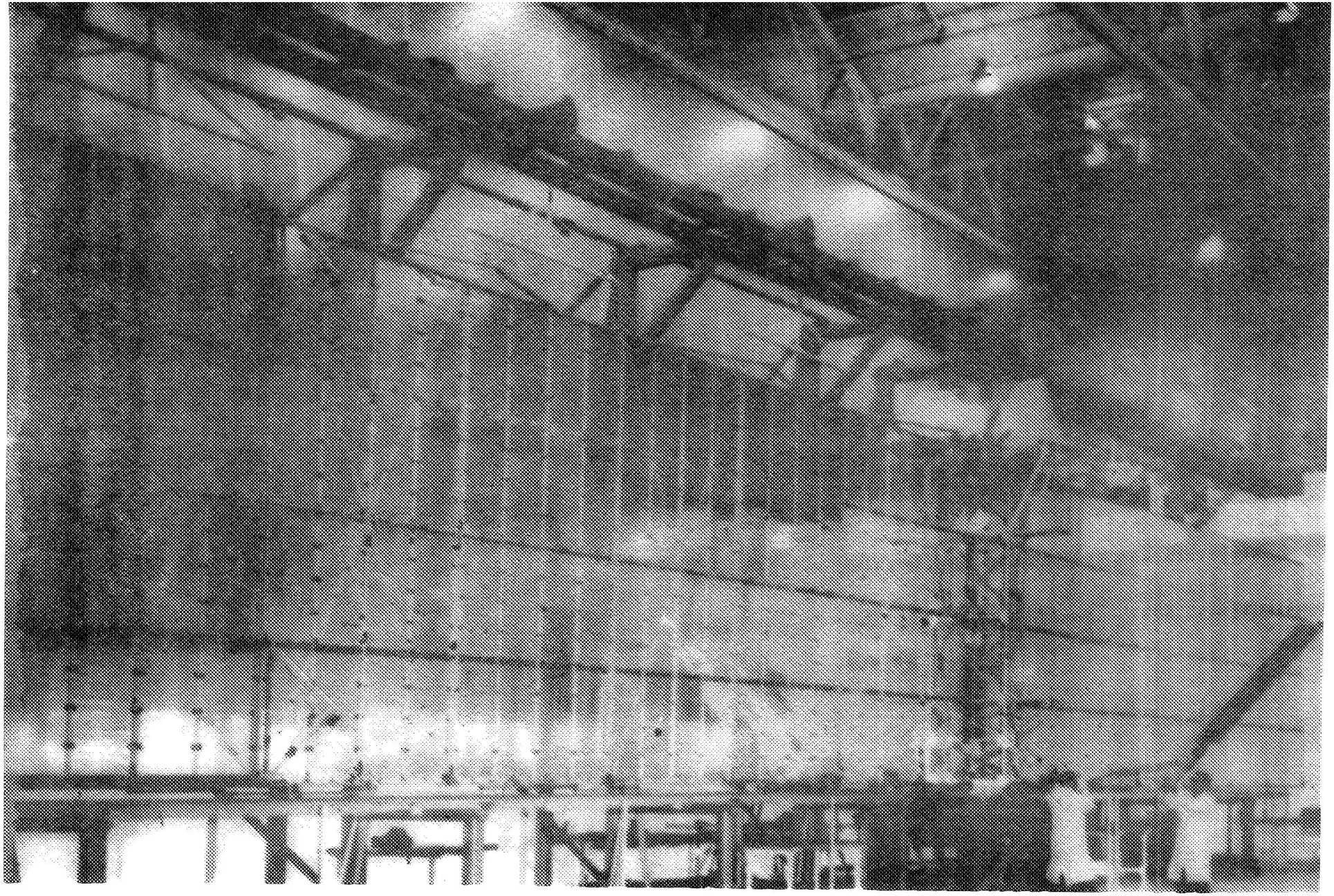

FIGURE 2

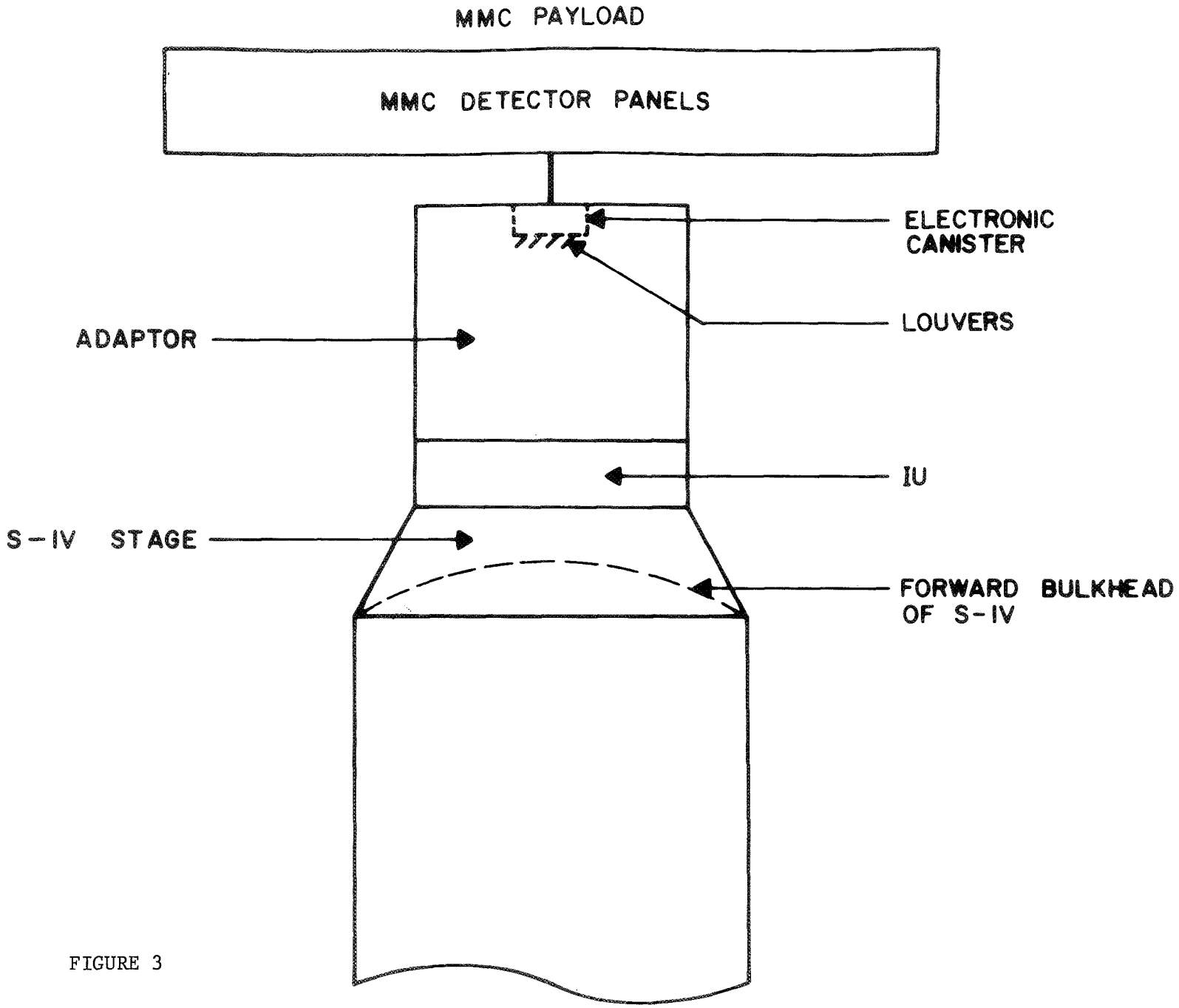
MMC PAYLOAD
MMC DETECTOR PANELS
ELECTRONIC CANISTER
LOUVERS
ADAPTOR
IU
S-IV STAGE
FORWARD BULKHEAD OF S-IV

FIGURE 3

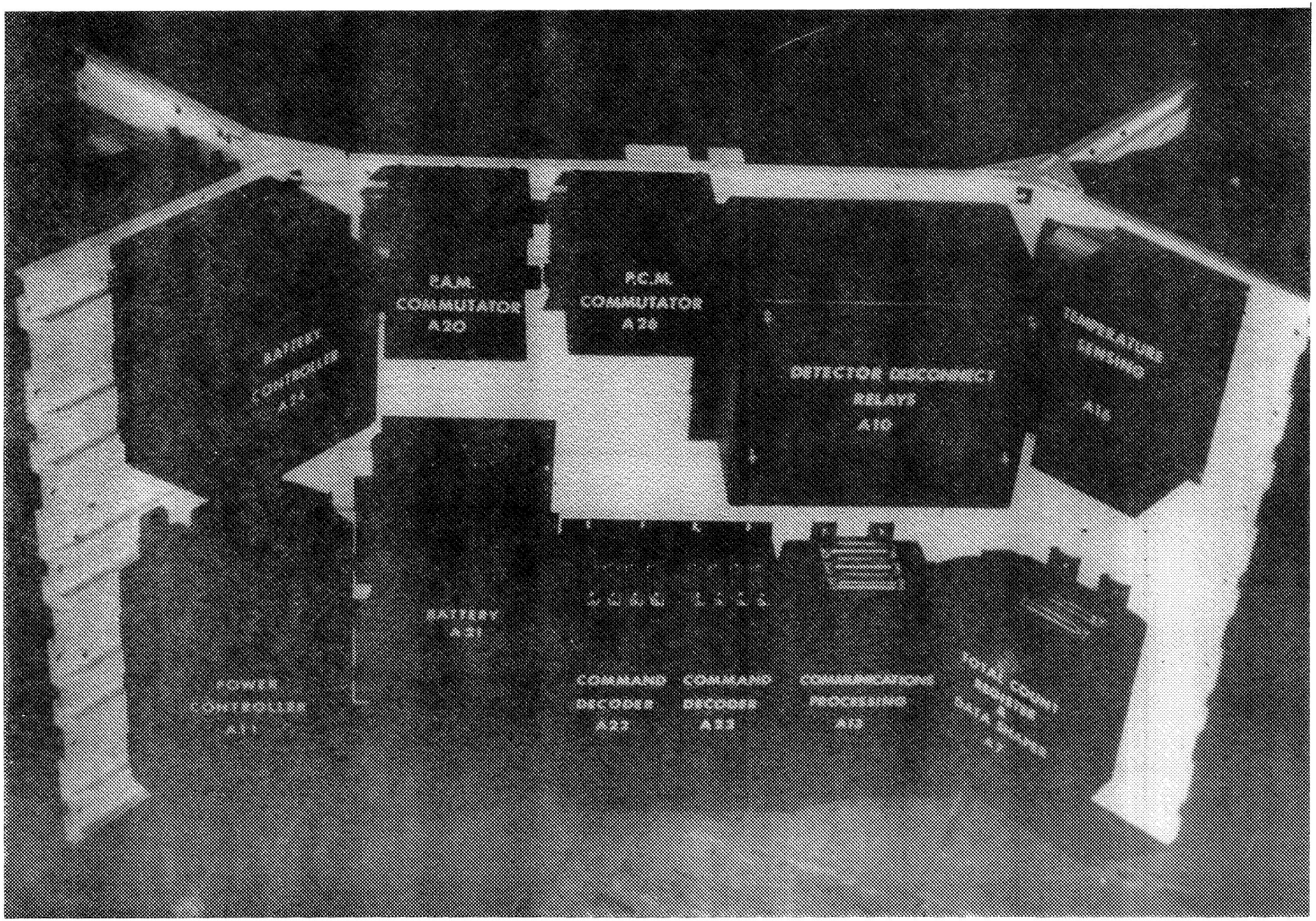
P.A.M.
COMMUTATOR
A20
P.C.M.
COMMUTATOR
A28
BATTERY
A21
POWER
CONTROLLER
A11
COMMAND
DECODER
A23
COMMAND
DECODER
A13

FIGURE 4

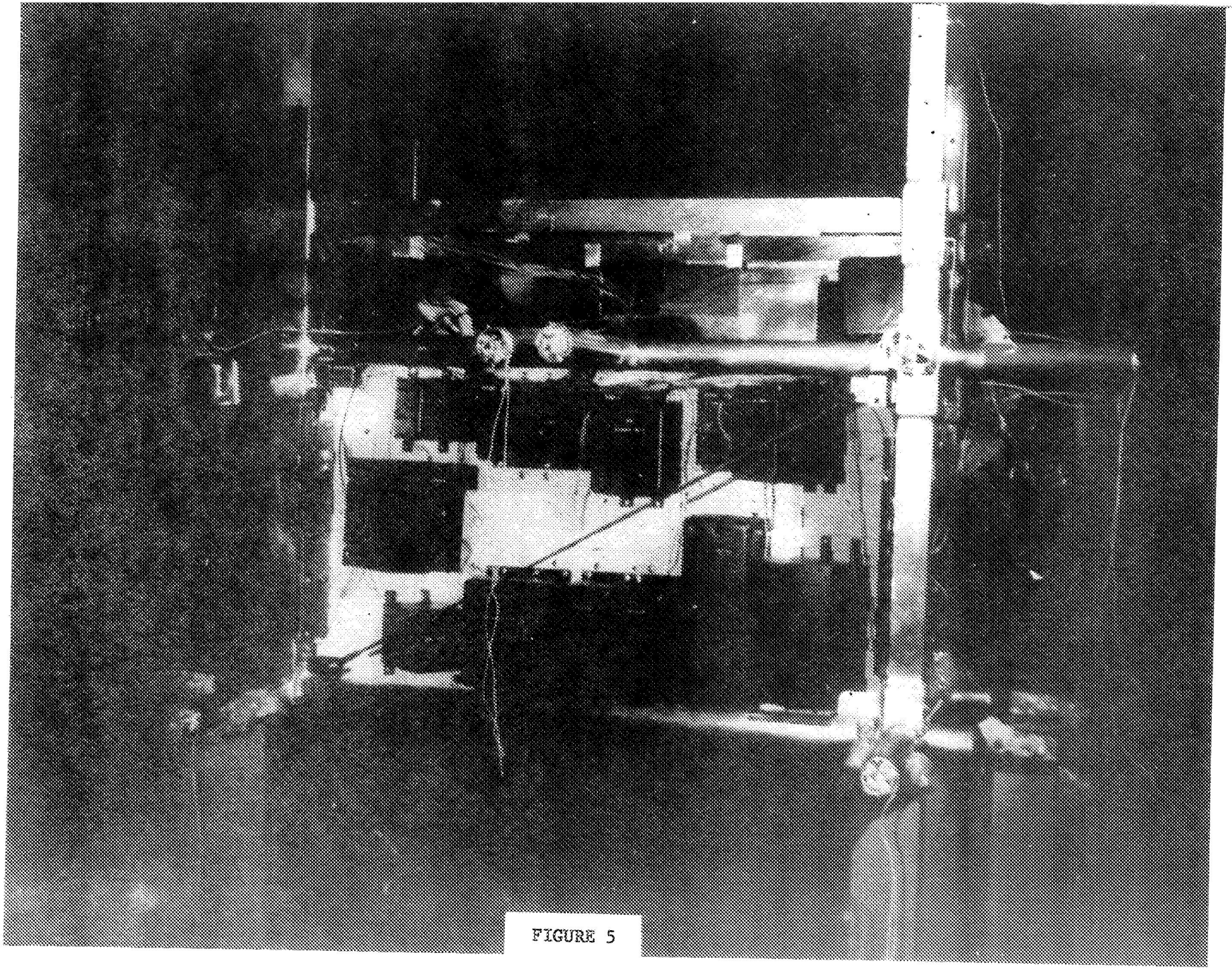

FIGURE 5

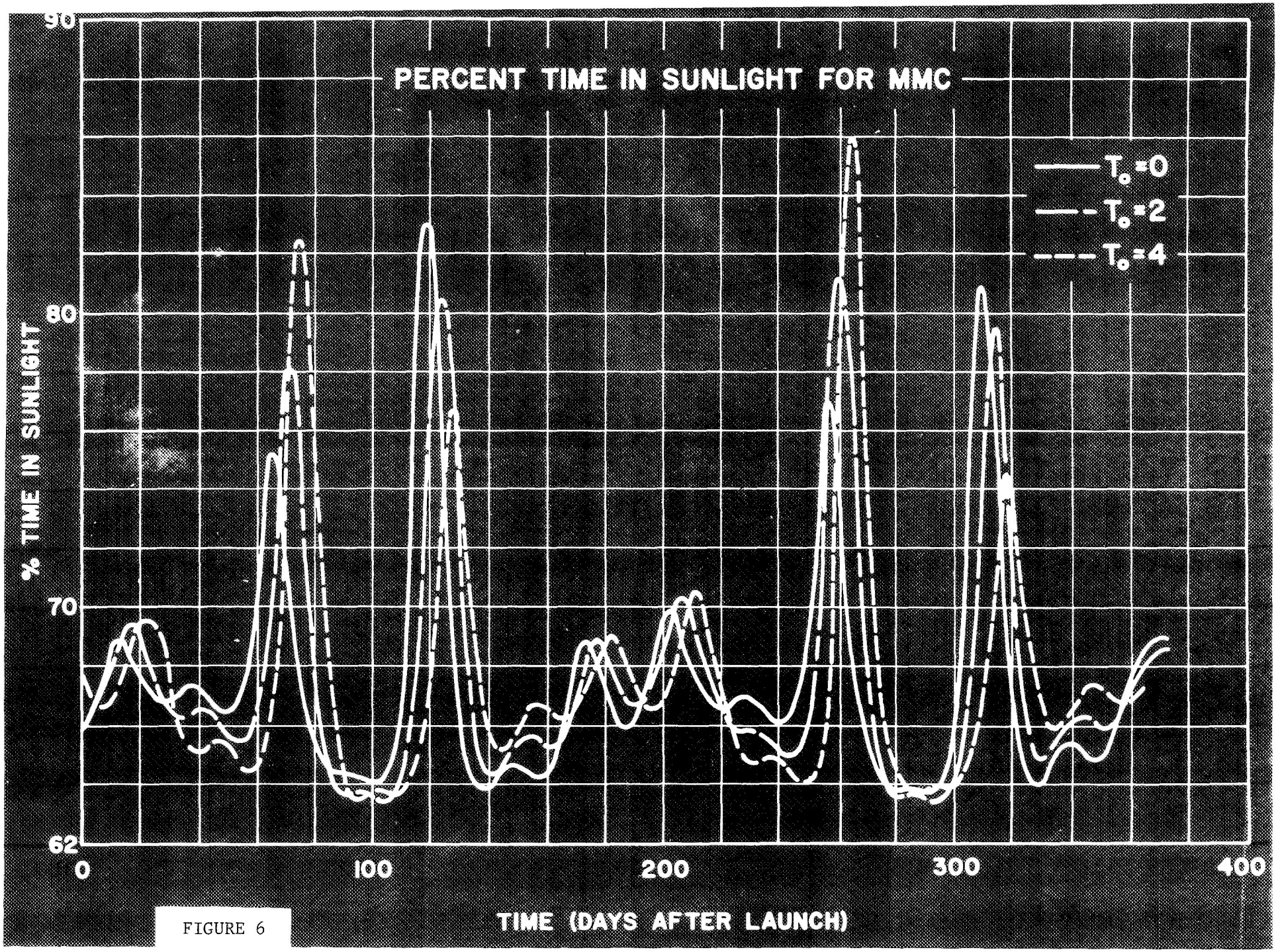
PERCENT TIME IN SUNLIGHT FOR MMC
T_o=0
T_o=2
T_o=4
% TIME IN SUNLIGHT
90
80
70
62
0
100
200
300
400
TIME (DAYS AFTER LAUNCH)

FIGURE 6

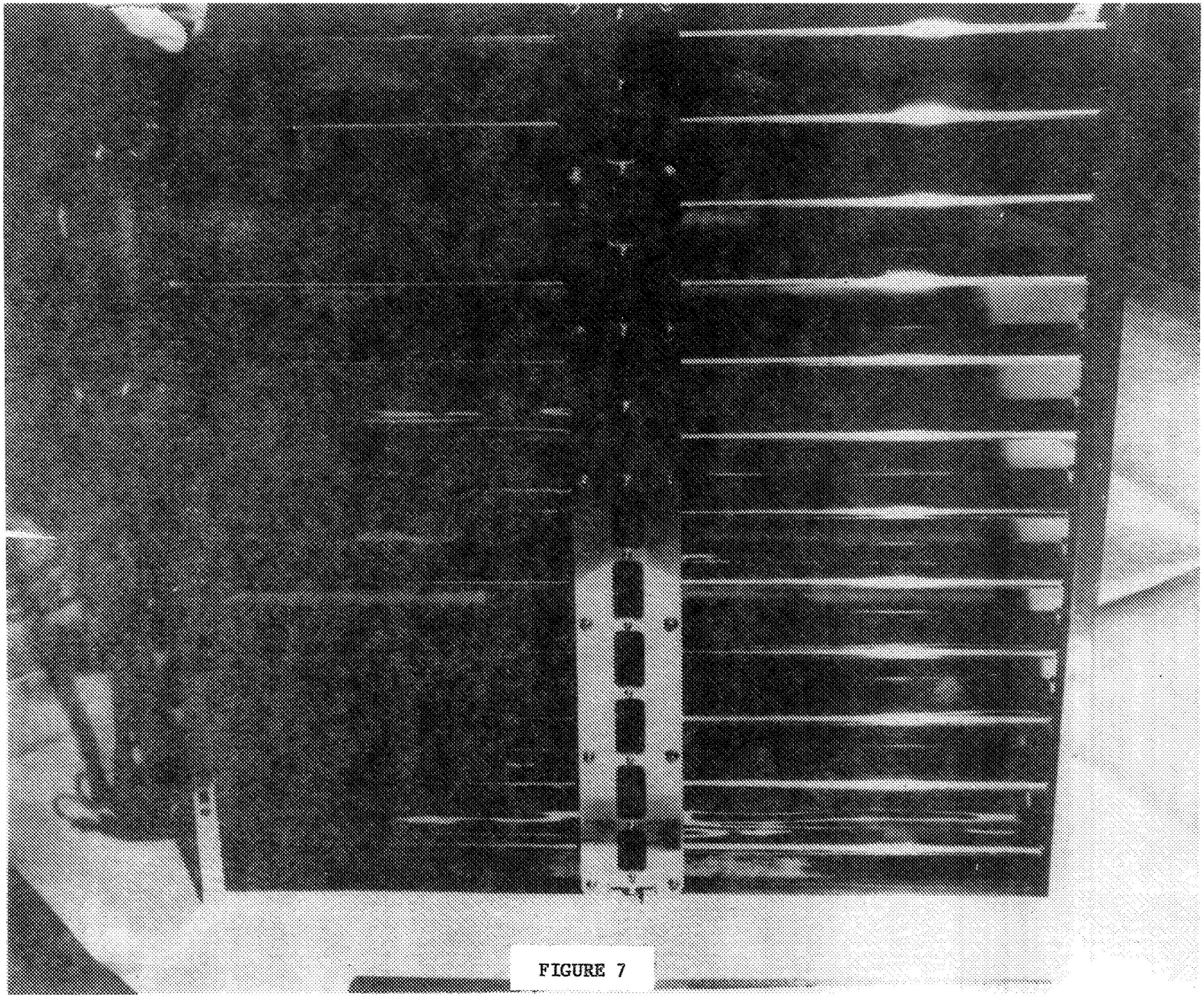

FIGURE 7